TECHNICAL MEMORANDUM

LANDFARMING AND COMPOSTING TREATABILITY STUDIES

ANNETTE ISLAND AIRPORT ANNETTE ISLAND, ALASKA

DRAFT
JULY 2000

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Total Environmental Restoration Contract
Contract No. DACA 85-95-D-0018
Task Order No. 06

TABLE OF CONTENTS

SECTION **PAGE**

TABLE OF CONTENTS

SECTION **PAGE**

FIGURES

ACRONYMS AND ABBREVIATIONS

AAC	Alaska Administrative Code
BIA	Bureau of Indian Affairs
BTEX	benzene, toluene, ethylbenzene, and xylene
CFR	Code of Federal Regulations
CQC	contractor quality control
DFW	definable feature of work
DRO	diesel-range organics
DQO	data quality objectives
EPP	Environmental Protection Plan
EPA	U.S. Environmental Protection Agency
FAA	Federal Aviation Administration
FUDS	Formerly-Used Defense Site
GRO	gasoline-range organics
HAZWOPER	hazardous waste operations and emergency response
HDPE	high-density polyethylene
HPC	heterotrophic plate count
MIC	Metlakatla Indian Community
PAH	polynuclear aromatic hydrocarbon
POL	petroleum, oil, and lubricants
PRG	preliminary remediation goal
QAPP	Quality Assurance Project Plan
QA/QC	quality assurance/quality control
QAR	Quality Assurance Representative
RBC	risk-based concentration
RRO	residual-range organics
TERC	Total Environmental Restoration Contract
USAED	U.S. Army Engineer District, Alaska
VOC	volatile organic compound

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1.0 INTRODUCTION

This technical memorandum describes activities required to conduct pilot-scale treatability studies of two bioremediation technologies -- composting and landfarming. The treatability studies will be conducted under typical field conditions encountered at Annette Island, Alaska. All work will be performed for the Federal Aviation Administration (FAA) under the U.S. Army Engineer District, Alaska (USAED) Total Environmental Restoration Contract (TERC), Contract Number DACA 85-95-D-0018, Task Order Number 14.

This technical memorandum is supplemental to the work plan prepared in support of environmental restoration activities being conducted by the USAED at Annette Island in 2000 (USAED 2000b). Detailed procedures specified in the work plan for field sampling, chemical quality control, waste management, site safety, environmental protection, and quality control are incorporated into this document by reference.

1.1 BACKGROUND

The Annette Island Airport was established in 1942 in support of World War II efforts. Facilities were originally constructed by the U.S. Army and subsequently operated by numerous parties, including the FAA. A complex fuel distribution and storage system supported airport operations, which is believed to be the primary source of fuel-related contamination in soil. Site 42, known as the Main Dock Tank Farm, provided the primary means to route and store fuel from ocean-going tankers in support of airport operations.

The location of Annette Island is shown in Figure 1-1. A detailed discussion of the Annette Island Airport history can be found in the documents cited in the references section of this report.

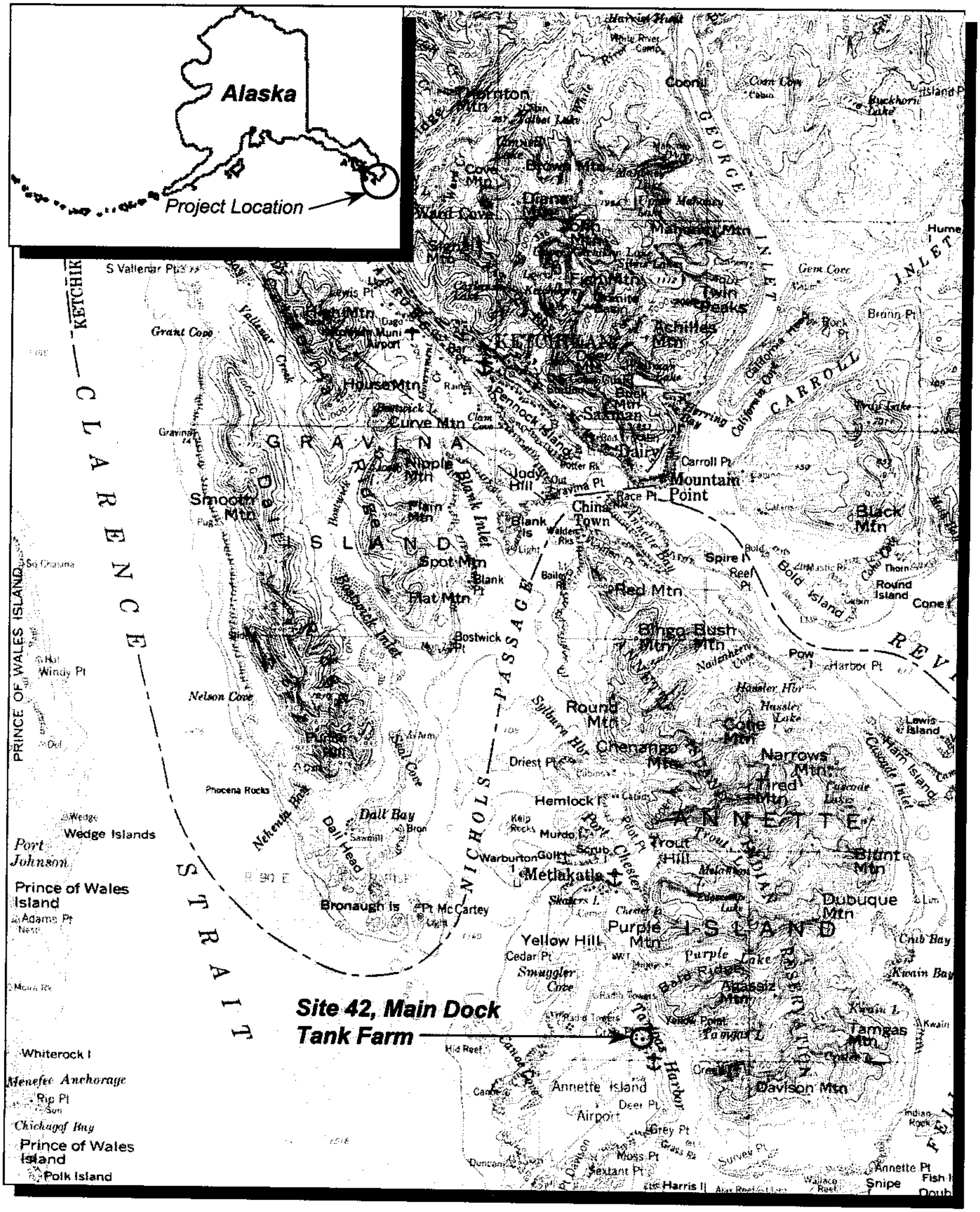


Figure 1-1 Location of Annette Island and the Main Dock Tank Farm

1.2 PROJECT OVERVIEW

Numerous investigations conducted at the Annette Island Airport have confirmed the presence of fuel-related compounds in soil at Site 42. A preliminary evaluation of remedial technologies conducted by the FAA identified several technologies that may be appropriate to cost-effectively remediate such soil (USAED, 2000a). Two of those technologies, composting and landfarming, were selected for further analysis and are the focus of the treatability studies described in this technical memorandum. Although the treatability studies will focus on Site 42 soils, results of the studies will be applicable to other sites with similar contaminant profiles.

1.2.1 Composting

Composting is a controlled biological process by which organic contaminants, including fuel-related compounds, are aerobically degraded to non-toxic compounds by naturally-occurring microorganisms. Soils are excavated and mixed with bulking agents, such as wood chips, to enhance the porosity of the mixture. Organic amendments, such as animal and vegetative wastes, are also added to the excavated soil to provide a nutrient source for the microorganisms. Soil moisture, oxygen content, nutrient ratios, and pH, are key operating parameters that require frequent monitoring and adjustment in order to maintain optimum process efficiency.

There are three process designs used in composting as follows:

- Aerated static pile composting (compost is formed into piles and aerated with blowers or vacuum pumps);
- Mechanically agitated in-vessel composting (compost is placed in a reactor vessel where it is mixed and aerated); and
- Windrow composting (compost is placed in long piles known as windrows and periodically mixed with mobile equipment).

Windrow composting is generally considered to be the most effective method as soil can be treated in large batches and the soil is aggressively mixed ensuring thorough treatment.

The composting treatability study at Annette Island will be conducted using wood waste (bulking agent) from local sawmill operations and fish waste (nutrient source) from local cannery operations. The study will be conducted using a small amount of fuel-contaminated soil mixed with wood chips and fish waste. Full-scale composting at Annette Island would likely be conducted using the windrow process; therefore the treatability study soil will be placed in a pile closely resembling a windrow to help ensure that data are the most representative of a full-scale operation. Because odors are anticipated due to decomposing fish waste, the study will be conducted in a relatively remote area.

Current analytical testing procedures have difficulty in distinguishing between organic materials such as wood waste, peat, and fish waste, and petroleum hydrocarbons. As such, quantifying the amount of fuel-related contamination in process soils is considered to be a significant issue. To help quantitate fuel-related compound concentrations in process soils, a control cell will be established and monitored throughout the study. The control cell will be comprised of uncontaminated soil mixed with wood and fish wastes at the same proportions as contaminated soil.

1.2.2 Landfarming

Landfarming is a bioremediation technology that also relies upon naturally occurring bacteria to consume organic contaminants. Depending upon soil type, contaminated soils are mixed with a bulking agent to enhance the soils' ability to contain oxygen and hence maintain aerobic degradation. Nutrients are added to the soil to provide a nutrient source to increase microbe populations and thus increase contaminant degradation rates. Nutrients are applied in the form of commercially available fertilizer, which is mixed with water and sprayed onto the soil. Similar to composting, maximum degradation efficiency is achieved by monitoring key operating parameters and making adjustments to maintain those parameters within an acceptable operating range. Key operating parameters include soil moisture, oxygen content, nutrient ratio, and pH.

Contaminated media is usually treated in lifts that are up to 18 inches thick. The soil is usually aerated with a tilling attachment towed by a tractor, allowing a large volume of material to be cost effectively treated. When the desired level of treatment is achieved, the lift is removed and a new lift is constructed. It is generally desirable to only remove the top of the remediated lift and then construct a new lift if additional material requires treatment by adding more contaminated media to the remaining material and mixing. This serves to inoculate the freshly added material with a large, active microbial culture, which can reduce the overall treatment duration.

The landfarming treatability study will be conducted in this manner to closely simulate full-scale operations. However, soil aeration will be conducted using a backhoe due to equipment availability on Annette Island. Depending on soil type, wood waste may be added to the soil in an effort to maintain proper soil aeration. Fertilizer will be imported to Annette Island and added as dictated through regular monitoring of process parameters. The landfarming treatability study will be conducted at an area adjacent to the composting treatability study.

1.3 REGULATORY FRAMEWORK

The FAA is currently developing cleanup criteria for the Annette Island project. However, for the purposes of the treatability studies, cleanup criteria will be selected as the lowest concentration for a given constituent published in the following sources:

- Cleanup levels set by the Metlakatla Indian Community (MIC);
- U.S. EPA Region 9 Preliminary Remediation Goals (PRGs);
- U.S. EPA Region 3 Risk-Based Concentrations (RBCs);
- State of Alaska Cleanup Levels;
- State of Washington Cleanup Levels; and
- State of Oregon Cleanup Levels.

As previously indicated, the biodegredation of fuel-related compounds in soil will be the focus of the treatability studies. Specifically, those constituents noted to exceed preliminary cleanup criteria in Site 42 soils will be monitored, including volatile organic compounds (VOCs) as 1,1-dichloroethylene and tetrachloroethylene, which were confirmed to be present at Site 42 at low concentrations. Table 1-1 identifies those constituents that were detected in

Site 42 soils during previous investigations and will be monitored during the treatability studies, the corresponding preliminary cleanup criteria, and the cleanup criteria source.

Table 1-1
Preliminary Cleanup Criteria

Constituent	Preliminary Cleanup Criteria (mg/kg)	Source
Gasoline-Range Organics	100	MIC, Residential
Diesel-Range Organics	200	MIC, Residential
Residual-Range Organics	200	MIC, Residential
Benzene	0.02	State of Alaska, migration to groundwater
Toluene	4.8	State of Alaska, migration to groundwater
Ethylbenzene	5.0	State of Alaska, migration to groundwater
Xylenes	20	MIC, Residential
Chlorobenzene	0.5	State of Alaska, migration to groundwater
Chloroform	0.24	U.S. EPA Region 9 PRG, Residential
1,2-Dichlorobenzene	6.0	MIC, Residential
1,4-Dichlorobenzene	0.7	MIC, Residential
1,1-Dichloroethylene	0.03	State of Alaska, migration to groundwater
Tetrachloroethylene	0.025	State of Alaska, migration to groundwater

1.4 PROJECT OBJECTIVES

The goal of this project is to determine if composting and landfarming are viable remedial technologies at Annette Island. In support of this goal, the following objectives have been identified:

Determine if composting and landfarming can reduce constituent concentrations to or below the preliminary cleanup criteria; and

- Determine if composting and landfarming are cost competitive with the best available demonstrated remedial technology (i.e., thermal desorption).

Section 2 includes detailed procedures that will be used to ensure that these objectives are achieved.

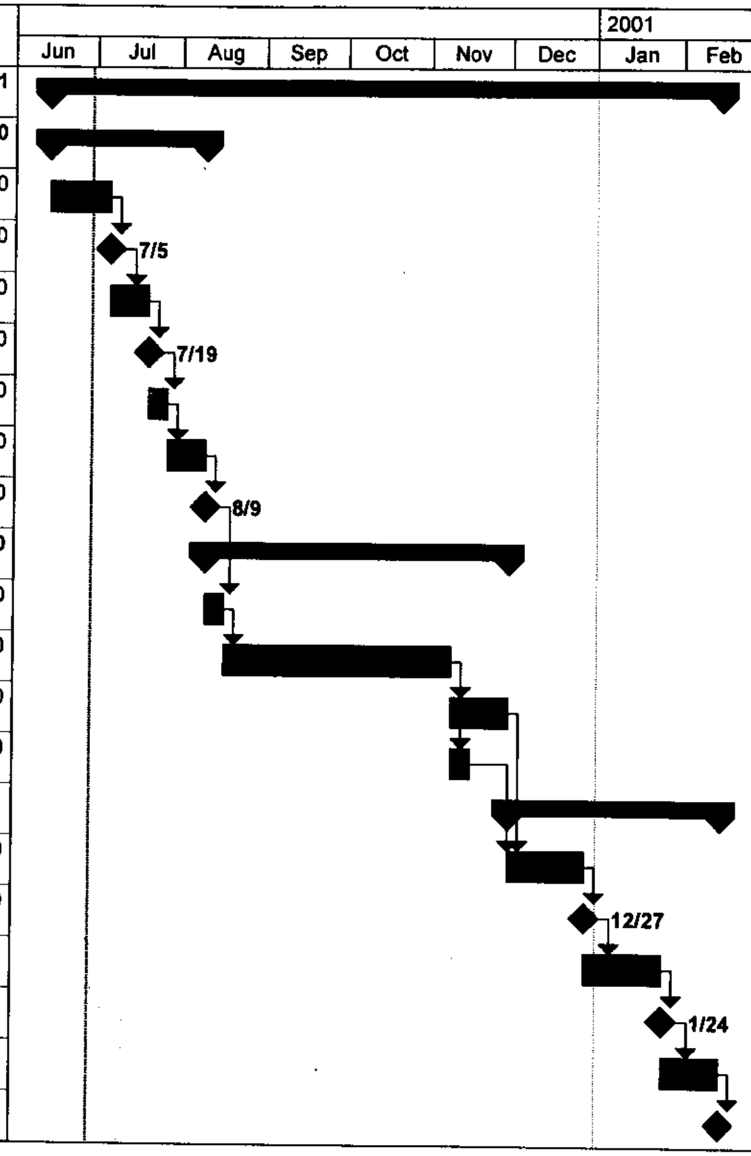
1.5 PROJECT SCHEDULE

The treatability studies will be conducted over a 12-week period during the summer of 2000. Fieldwork is tentatively planned to begin early August and be completed by late November. The project schedule is provided in Figure 1-2.

1.6 PROJECT ORGANIZATION

Organization of the project will be the same as that proposed in the 2000 Annette Island Formerly Used Defense Site (FUDS) Work Plan (USAED 2000b).

ID	Task Name	Duration	Start	Finish
1	**Landfarming and Composting Treatability Studies**	**175 days**	**Wed 6/14/00**	**Wed 2/14/01**
2	**Technical Memorandum**	**40 days**	**Wed 6/14/00**	**Wed 8/9/00**
3	Prepare Draft	15 days	Wed 6/14/00	Wed 7/5/00
4	Submit Draft	0 days	Wed 7/5/00	Wed 7/5/00
5	Client Review	10 days	Thu 7/6/00	Wed 7/19/00
6	Client Comments Due	0 days	Wed 7/19/00	Wed 7/19/00
7	Comment Responses	5 days	Thu 7/20/00	Wed 7/26/00
8	Incorporate Comments	10 days	Thu 7/27/00	Wed 8/9/00
9	Submit Final	0 days	Wed 8/9/00	Wed 8/9/00
10	**Field Work**	**80 days**	**Thu 8/10/00**	**Wed 11/29/00**
11	Construct Treatment Cells	5 days	Thu 8/10/00	Wed 8/16/00
12	Conduct Studies	12 wks	Thu 8/17/00	Wed 11/8/00
13	Final Sample Analyses	15 days	Thu 11/9/00	Wed 11/29/00
14	Decommission Treatment Cells	5 days	Thu 11/9/00	Wed 11/15/00
15	**Reporting**	**55 days**	**Thu 11/30/00**	**Wed 2/14/01**
16	Prepare Draft	20 days	Thu 11/30/00	Wed 12/27/00
17	Submit Draft	0 days	Wed 12/27/00	Wed 12/27/00
18	Client Review	20 days	Thu 12/28/00	Wed 1/24/01
19	Client Comments Due	0 days	Wed 1/24/01	Wed 1/24/01
20	Incorporate Comments	15 days	Thu 1/25/01	Wed 2/14/01
21	Submit Final	0 days	Wed 2/14/01	Wed 2/14/01



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Task
Split
Progress
Milestone
Summary
Rolled Up Task
Rolled Up Split
Rolled Up Milestone
Rolled Up Progress
External Tasks
Project Summary

Figure 1-2 -- Treatability Studies Schedule

2.0 DEFINABLE FEATURES OF WORK

Definable features of work (DFWs) were developed based on achieving the project objectives defined in Section 1.4. DFWs are defined as main project activities that are fundamentally unique in nature. For the landfarming and composting treatability studies, the following DFWs have been identified:

- Pre-mobilization activities;
- Mobilization and work area set-up;
- Containment cell construction;
- Treatability study initiation;
- Treatability study operation and maintenance;
- Sampling and analysis;
- Treatability study decommissioning; and
- Waste management and disposal.

Tasks that will be conducted to implement each DFW are detailed in the following sections.

2.1 PRE-MOBILIZATION ACTIVITIES

Pre-mobilization activities are those tasks that must be completed prior to the start of work and include procurements, permitting, and planning meetings. These tasks are summarized in the following paragraphs.

2.1.1 Procurements

Performance of the treatability study will require the following subcontracts to be established:

- Civil construction/operation and maintenance;
- Waste treatment/disposal; and
- Analytical laboratory services.

2.1.2 Permits, Licenses, and Certifications

The initial construction of the containment cells requires permits, licenses, and certifications from federal and local agencies. Jacobs will obtain all necessary permits or otherwise coordinate with these entities as appropriate. Utility locates will be performed prior to excavating contaminated soil at Site 42 and excavating uncontaminated soil at a location to be determined. The following items will be specifically required for this project:

Permits:

- Right of Entry -- Prior to mobilization, the USAED will obtain a right of entry from the MIC for work on Annette Island.
- A wastewater discharge permit will be required prior to the initiation of the treatability study, and is being obtained as a part of preparation of the 2000 Annette Island FUDS Work Plan (USAED 2000b). Excess water that contacts contaminated soil during the treatability study will be collected, treated, and discharged in accordance with the permit.

Licenses:

- All Jacobs and subcontractor personnel will carry personal identification and any applicable licenses needed for the operation of equipment.

Certificates:

- 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) training (required for all field personnel);
- USAED CQC training (required for the CQC system manager); and
- Proof of insurance for entities involved in subcontracted transportation.

Manifests:

- Manifests are required by the USAED for the transport of contaminated materials. Other than spent activated carbon generated as part of water treatment, no wastes are anticipated to be generated as part of the treatability studies.

2.1.3 Pre-Construction Conference

Following award of subcontracts and prior to construction, a pre-construction conference will be conducted to ensure that all field aspects of the project are fully understood by all parties. The Jacobs field team, the USAED, the FAA, the civil construction subcontractor's foreman, and key field staff will attend this conference. A safety briefing will be provided to the project team by the Jacobs safety and health manager as a part of the pre-construction conference. This meeting will be conducted onsite at Annette Island.

2.1.4 Mutual Understanding Meeting

The mutual understanding meeting will be coordinated and conducted by the USAED Quality Assurance Representative (QAR). This meeting is generally conducted at the project work area prior to the initiation of fieldwork.

2.2 MOBILIZATION AND WORK AREA SETUP

Mobilization and work area setup will be conducted after all pre-construction activities have been completed. This will include the transportation of personnel, equipment, and supplies required to complete the project.

2.3 CONTAINMENT CELL CONSTRUCTION

The civil construction subcontractor will provide all labor, materials, and equipment to complete the construction of the containment cells in accordance with the requirements in 18 Alaska Administrative Code (AAC) 75.370, *State of Alaska Contaminated Sites Regulations, Soil Storage and Disposal*. In addition, relevant portions of 40 Code of Federal Regulations (CFR) Part 265, Subpart L, *Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities*, will be used to help guide containment cell construction.

To support the treatability studies, three 20-foot by 20-foot containment cells will be constructed. Two cells will be equipped with an impermeable liner system and will be used to contain contaminated soil for the composting and landfarming efforts. A third unlined cell will be used as the control cell, and will contain uncontaminated soil and soil amendments. The procedures that will be followed to construct the containment cells are specified in the following subsections.

The location for constructing the containment cells is tentatively selected as the quarry area adjacent to the Metlakatla Landfill. This location will be used by both the USAED and FAA to stage wastes, decontaminate equipment, and treat contaminated water. The area is also centrally located to the Annette Island Packing Company (fish waste source) and wood waste landfills, making the area the most convenient location to conduct treatability study operations. There are no residences within one mile of the study location so odors should not bother local residents. However, a significant amount of activity is expected in the quarry area during the FY 2000 field season, which might make this location impractical. The final location of the treatability study will be specified in the Final Technical Memorandum.

2.3.1 Containment Cell Ground Surface Preparation

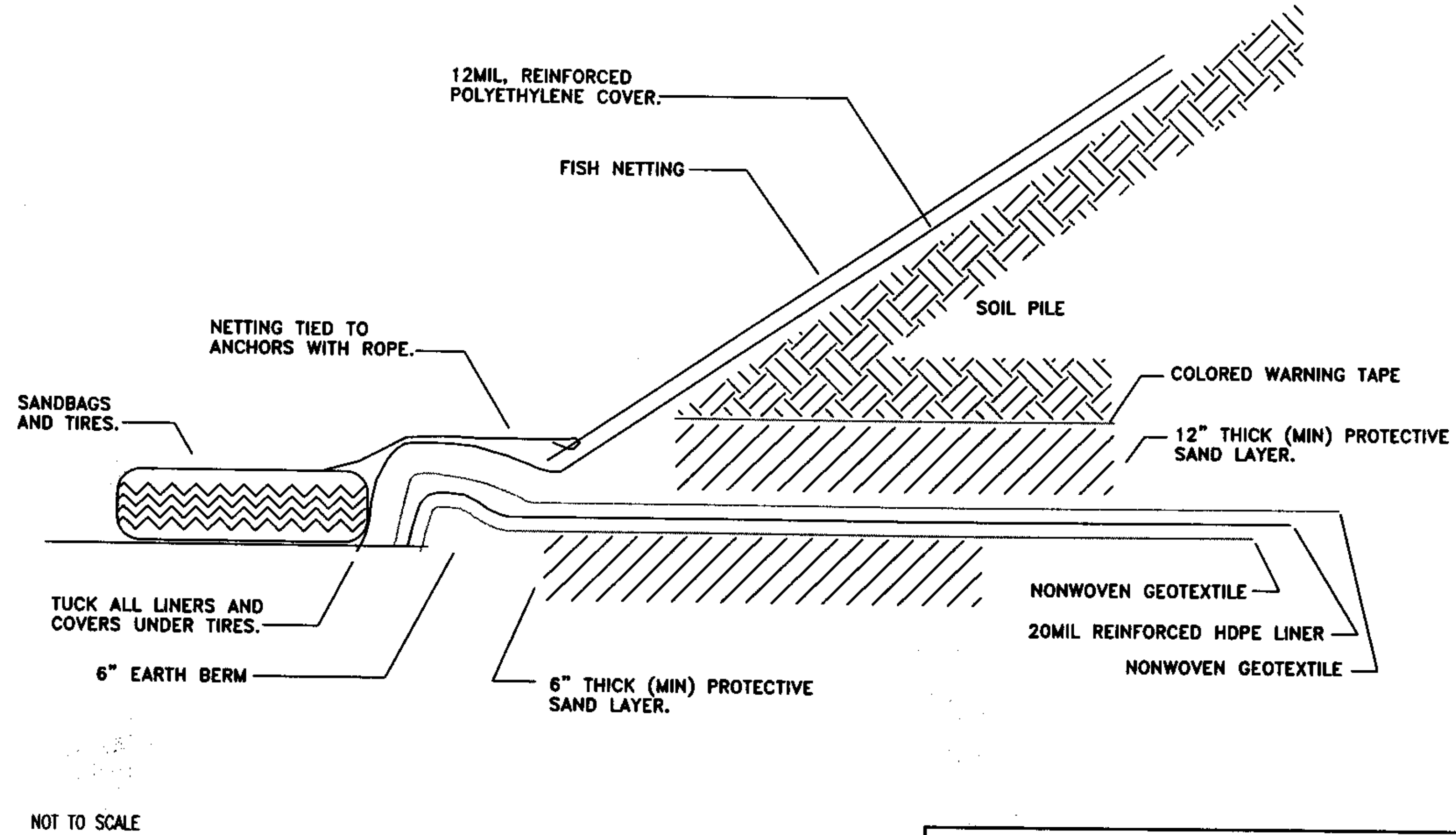
The ground surface for the two lined containment cells will be prepared as follows:

1. Level the area that will provide the foundation for the bottom liner to within 0.5% slope.
2. Remove all pointed rocks and other sharp objects that may puncture the liner.
3. Place a minimum of six inches of sand or other fine material on the ground surface as a foundation and protective layer for the bottom liner.
4. Construct a six-inch high berm made of clean soil around the perimeter of the cell.

2.3.2 Containment Cell Liner System Installation

The liner system for the two lined containment cells will be prepared as follows (see Figure 2-1):

1. Nonwoven geotextile liner
   a. Handle geotextiles in a manner to ensure they are not damaged and in accordance with manufacturer's instruction.
   b. Anchor geotextile securely and deploy it in a controlled manner to continually keep geotextile in tension.
   c. Place geotextile liner within the perimeter of the constructed berm and on top of the six-inch foundation sand layer.
   d. In the presence of wind, anchor geotextile with sandbags or equivalent. Do not remove weight from the geotextile liner until covered with bottom liner.
   e. Prevent damage to underlying layers during placement of geotextile.
   f. During geotextile deployment, do not entrap stones or excessive fine material on or beneath geotextile.
   g. Visually examine entire geotextile surface. Ensure no potentially harmful foreign objects are present. Remove foreign objects encountered or replace geotextile.



SOIL PILE LINER AND COVER DETAIL
ANNETTE ISLAND, ALASKA

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h. Overlap adjacent edges at least 12 inches. Ensure top edges face downgrade. Seaming is not required.

i. Repair holes or tears in geotextile as directed by manufacturer's instructions.

j. When placing soil materials on top of geotextile, ensure that geotextile and underlying liner materials are not damaged, minimize slippage of geotextile on underlying layers, ensure no excess tensile stresses occur in the geotextile, and ensure overlapping of adjacent edges is maintained.

k. The nonwoven geotextile liner will meet the minimum specifications listed in Table 2-1.

Table 2-1
Nonwoven Geotextile Liner Material Specifications

Parameter	Specification
Weight (ASTM D3776)	8 ounces per square yard
Thickness (ASTM D1777)	110 mil
Grab tensile strength (ASTM D4632)	150 pounds
Grab tensile elongation (ASTM D4632)	20 percent
Trapezoid tear strength (ASTM D4533)	80 pounds
Puncture resistance (ASTM D4833)	130 pounds
Permeability (ASTM D4491)	0.10 cm/sec
Apparent opening size (AOS) (ASTM D4751)	70 U.S. standard sieve size

2. Bottom liner

a. Handle bottom liner in a manner to ensure it is not damaged and is in accordance with manufacturer's instruction.

b. Use a single piece of reinforced high-density polyethylene (HDPE) liner which has been pre-seamed by the manufacturer. No seaming shall be performed in the field. Place bottom liner on top of nonwoven geotextile liner covering berm.

c. Anchor bottom liner securely and deploy it in a controlled manner to continually keep bottom liner taut to prevent overlap.

d. In presence of wind, weight bottom liner with sandbags or equivalent.

e. Trim bottom liner with scissors or other approved device.

f. During bottom liner deployment, do not entrap stones or excessive fine material that could damage the bottom liner.

g. Visually examine entire bottom liner surface. Ensure no potentially harmful foreign objects are present. Remove foreign objects encountered or replace bottom liner.

h. Repair holes or tears in bottom liner as directed by manufacturer's instructions.

i. The HDPE liner shall meet the minimum specifications listed in Table 2-2.

Table 2-2
HDPE Liner Material Specifications

Parameter	Specification
Cold crack (ASTM D2136)	-60°F or lower
Black carbon content (ASTM D1603)	2 percent
Carbon dispersion (ASTM D3015)	A-2 range
Tensile strength (ASTM D751A) (for coated fabric liner only)	300 pounds (warp)
Mullen burst (ASTM D751A) (for coated fabric liner only)	500 pounds per square inch
One-inch tensile strength (ASTM D882) (for extruded fabric liner only)	45 pounds (warp)
One-inch elongation MA (Machine direction) (for extruded fabric liner only)	625 percent
Nominal thickness	20 mil
Oil resistance (ASTM D471)	No signs of deterioration and more than 80 percent retention of tensile and seam strength after immersion for 30 days at 73°F

3. Nonwoven geotextile liner

   a. Place geotextile liner within the perimeter of the constructed berm and on top of the bottom liner in the same manner as described in Step 1.

   b. Place 12 inches (minimum) of clean sand on top of geotextile liner in a manner that prevents damage to liner. Place colored warning tape (minimum of 1-inch wide) on top of clean sand.

   c. Place contaminated soil in stockpile containment cell in a manner that prevents damage to the liner system.

4. Top Liner (covers contaminated soil)

   a. Anchor top liner securely and deploy it in a controlled manner to continually keep top liner taut. Extend liner to foot of stockpiled soil to cover soil and tuck beneath the bottom liner.

   b. Weight top liner with sandbags or equivalent until the netting material has been placed and anchored.

   c. Overlap adjacent edges of the topliner according to manufacturer's instructions. Place sand bags or equivalent on unsecured overlaps every 5-feet to prevent wind damage of liner.

   d. Repair holes or tears in top liner as directed by manufacturer's instructions.

   e. Top covers shall meet the requirements specified for bottom liners.

5. Netting
   a. Place netting over top liner as shown in the Figure 2-1. The purpose of the netting is to hold the top liner in place during periods of high winds (up to 50 mph) and to minimize any wind damage to the polyethylene liner.
   b. Overlap netting seams by at least 1-foot.
   c. Place stakes at a minimum depth of 1-foot and at a minimum spacing of 3-feet in a location at the outside of the berm after it is pushed against the outer side of the top liner.

2.3.3 Control Containment Cell

The control containment cell will consist of only a 20-foot by 20-foot 6-inch berm made of clean soil described in Section 2.3.1, and a top cover and netting described in Section 2.3.2. No contamination will be present in the control containment cell thereby negating the necessity for protective sand layers and a bottom liner system.

2.4 TREATABILITY STUDY INITIATION

The treatability studies will be initiated after the containment cells are completed. Initiation will consist of soil excavation and transportation to the containment cells, addition of soil amendments, composting and landfarming pile construction, initial sampling, and preparing treatment cells for operation and maintenance. The following sub-sections describe treatability study initiation in detail.

2.4.1 Soil Excavation and Material Transportation to Containment Cells

Approximately 10 cubic yards of fuel-contaminated soil will be excavated from the Main Dock Tank Farm (Site 42 – see Figure 1-1) and transported to the containment cell area. The 10 cubic yards of fuel-contaminated soil will be thoroughly mixed, split, and equal amounts placed in the composting and landfarming treatability study cells.

Approximately 5 cubic yards of clean soil will be excavated from an area that has previously been declared uncontaminated and transported to the containment cell area. The 5 cubic yards of uncontaminated soil will be placed in the control cell.

Approximately 5 cubic yards of wood waste in the form of saw dust or wood chips will be obtained from one of several bark disposal areas (i.e., adjacent to Skater's Lake, adjacent to the Bureau of Indian Affairs (BIA) Roads Construction Department, or at the north end of Runway B). The wood waste may be partially buried and minor soil excavation may be required to obtain the wood waste. Efforts will be made to obtain wood waste that is not water logged or decomposing. Following wood chip excavation, the area disturbed will be rough graded to match the existing ground contour to the extent practical. The wood chips will be transported to the containment cell area for use as a bulking agent.

Approximately 2 cubic yards of fish waste will be obtained from the Annette Island Packing Company located in Metlakatla. The fish waste will be transported in poly-totes to the composting and control containment cells by the civil subcontractor. This material will be used as a nutrient source for the composting and the control cells.

2.4.2 Addition of Soil Amendments

Various soil amendments will be mixed within the containment cells with the appropriate excavated soil prior to constructing the three separate piles as discussed in Section 2.4.3. The soil amendments consist of fish waste or fertilizer for a nutrient source, wood chips for a bulking agent, water, and potentially lime to balance pH. The appropriate amounts and purposes of the amendments specific to each pile are presented in Table 2-3; ratios presented in this table are volumetric based.

The need for additional soil amendments in each pile will be re-evaluated at intervals detailed in Table 2-4 in an effort to optimize the degradation process. The parameters that will be evaluated and their acceptable operating ranges are discussed in Section 2.5; the sampling frequency is discussed in Section 2.6.

Table 2-3
Soil Amendments

Amendment	Units	Containment Cells			Purpose
		Composting	Landfarming	Control	
Fish Waste	Amendment to soil ratio	1:5	NA	1:5	Provide nutrients to augment naturally occurring nutrients
Wood Chips	Amendment to soil ratio	1.5:5	None or 1:5, depending on soil type	1.5:5	Bulking agent, used to increase porosity and permeability of the soil
N-P-K Fertilizer	Pounds	NA	TBD based on pre-study samples	NA	Provide nutrients to augment naturally occurring nutrients. Ideal N-P-K ratio is 10-1-1 for every 100 parts of carbon
Water	% field capacity	60%-80%	60%-80%	60%-80%	Provides optimum environment for microbes
Soil conditioner (i.e., limestone rock or acidic solution)	Pounds	TBD based on pre-study samples	TBD based on pre-study samples	TBD based on pre-study samples	Adjusts pH to within 6-8 pH units

NA – Not applicable
TBD - To be determined
N-P-K - ratio of nitrogen to phosphorus to potassium

2.4.3 Pile Construction

Piles will be constructed inside each of the three containment cells after the addition and mixing of the soil amendments discussed in Section 2.4.2. Large pieces of inorganic material (i.e., rocks) will be removed from the piles and large chunks of soil will be broken up during pile construction.

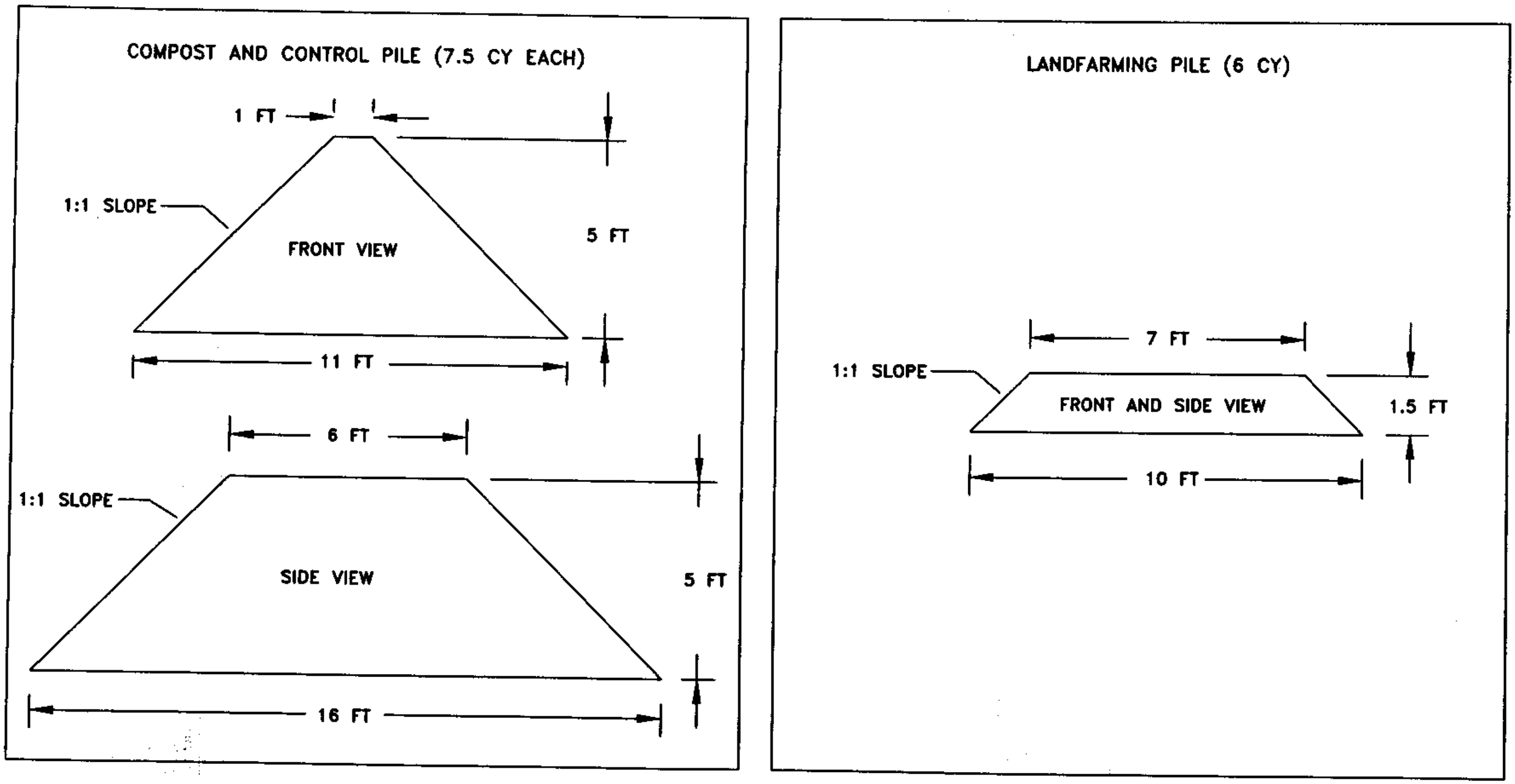
The soil pile for the composting treatability study will consist of 5 cubic yards of fuel-contaminated soil, 1.5 cubic yards of wood chips, and 1 cubic yard of fish waste (see Table 2-3). The pile will be approximately 11-feet wide and 16-feet long at the base with a side slope of 1:1. The top of the pile will be flattened to 1-foot wide by 6-foot long to closely resemble a windrow that would be constructed during full-scale implementation. This shape will also result in the greatest retention of internal pile heat. Figure 2-2 provides the composting pile dimension layout.

The soil pile for the landfarming treatability study will consist of 5 cubic yards of petroleum, oil, and lubricants (POL)-contaminated soil. Wood chips may also be added depending on field observation of soil type and porosity; if the soil has little porosity, then wood chips will be qualitatively added to create air pockets within the pile (see Table 2-3). Care will be taken during pile construction to avoid compacting the soil. Based on field test kit results for carbon, nitrogen, phosphorus, and potassium content of the POL-contaminated soil, fertilizer will also be added in solution form to reach a 10-1-1 N-P-K ratio for every 100 parts of carbon (see Table 2-3). The fertilizer solution will be sprayed onto the pile and will be mixed in thoroughly during pile construction. The pile will be approximately 10-feet wide by 10-feet long and 18-inches deep with a side slope of approximately 1:1. Figure 2-2 provides the landfarm pile dimension layout.

The soil pile for the control cell will consist of 5 cubic yards of uncontaminated soil, 1.5 cubic yards of wood chips, and 1 cubic yard of fish waste. The pile will have approximately the same dimensions as the composting treatability study cell.

2.4.4 Initial Sampling

Following construction of the three piles, initial field and analytical sampling will be conducted to determine the initial condition of the piles and to fine tune key operating parameters. The field sampling results will determine if additional soil amendments are necessary to achieve optimal pile conditions. The analytical sampling results will be used to establish the initial concentrations of contaminants in the piles. The analytical sampling requirements are discussed in Section 2.6. The field sampling parameters, operating ranges, and corrective actions to take if the measured level falls outside the operating range are listed in Table 2-4. Field parameters will be collected throughout the duration of the treatability study, therefore the frequency is also included in Table 2-4 and discussed more thoroughly in Section 2.5. In addition, the specific procedures used to collect the field parameters are discussed in Section 2.5.



TREATABILITY AND CONTROL PILE DIMENSIONS ANNETTE ISLAND, ALASKA		
PROJ MGR: L. DOKOOZIAN	ACAD FILE NO: FIG2-2	FIGURE NO: 2-2
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PLOT SCALE: 1=1

Table 2-4
Field Parameters and Operating Ranges

Parameter	Units	Sampling Frequency	Operating Range	Corrective Action
Oxygen	Percent	• Daily during first two weeks • Every week thereafter just prior to pile mixing	4-21%	• If O_2 levels fall below 4% then the pile is operating under anaerobic conditions and more frequent turning of the pile is necessary. Turn pile and recheck O_2 levels after 4 days. Continue to shorten intervals between turning events until O_2 levels remain above 4% • If O_2 levels are near 21%, turn pile less frequently to allow O_2 levels to decrease
Temperature	°C	• Daily during first two weeks • Weekly thereafter prior to pile mixing	10 - 60°C	• If temperature exceeds 60°C then remove the HDPE cover to lower the temperature • There is no corrective action for low temperatures as biological processes will continue to degrade fuel contaminants down to 10°C
pH	pH units	• At same time as analytical sampling	6-8	• If pH is below 6 then add crushed limestone rock to bring the pH above 6. Amounts of limestone rock to raise the pH will be calculated on an as-needed basis • In the unlikely event pH is above 8 then add a commercially purchased acidic solution to lower the pH. Amounts of acidic solution required will be calculated on an as-needed basis
Moisture content	Percent	• At same time as analytical sampling	40-80%	• During dry weather, remove top liner to lower moisture content to less than 80%. In wet weather, do not add additional water during pile turning • If moisture levels in any of the piles are below 40%, then water will be sprayed onto the pile. Amount of feed water will be calculated on an as-needed basis
Nutrients (N-P-K)	Ratio	• At same time as analytical sampling	10:1:1	• If nutrient levels fall below the optimum ratio then add specific nutrient(s) to reach optimal ratio. Amounts of nutrients to add will be calculated on an as-needed basis • Fertilizer will be added to the landfarm pile as necessary and fish waste will be added to the compost pile as necessary. Identical amounts of fish waste will be added to the control pile if added to the compost pile. The compost pile may be further amended with fertilizer if the optimum ratio cannot be obtained through the use of fish waste

2.4.5 Preparing Cells for Operation and Maintenance

Following pile construction and initial sampling, the three piles will be covered with a 12-mil HDPE top liner. The liner will be secured as shown in Figure 2-1 using fish netting and tires or other similar weights. Operation and maintenance of the piles will occur as detailed in Section 2.5.

2.5 TREATABILITY STUDY OPERATION AND MAINTENANCE

Following cell and pile construction, soil amendment addition, and initial sampling, operation and maintenance of the piles will be conducted for 12 weeks. The studies may be extended beyond the initial 12-week period if approved by the FAA and USAED.

Maintenance of the piles will consist of ensuring that the containment cell soil berms and liners are not compromised during treatability study operations. Any damages to the berms or liners will be repaired immediately. Covers will also be repaired as necessary if they are torn during operation. Excess water that collects in the containment cells will be pumped out of the cells, transported to and treated at the water treatment system that will be mobilized as a part of FUDS field work at Annette Island, and discharged in accordance with the wastewater discharge permit. The operation of the composting and control cells, and the landfarming cell are discussed in the following subsections.

2.5.1 Composting Cell and Control Cell Operation

The composting and control piles will be turned weekly using a backhoe. Field parameters might dictate more frequent turning if oxygen levels are measured below the operating range (see Table 2-4). Prior to turning the soil, the HDPE covers will be removed and field parameters and analytical samples will be collected as necessary. Turning will be accomplished by moving the pile from one side of the containment cell to the other side, thereby reverse stacking the pile at least once each week and thoroughly aerating the soil. Turning and stacking will be conducted in a manner to minimize soil compaction. After turning the soil, the HDPE covers will be repositioned over the piles. Analytical sampling frequency and methods are discussed in Section 2.6. Field parameter sample frequencies are presented in Table 2-4; sampling procedures are detailed in Table 2-5.

Table 2-5
Field Parameter Collection Procedures

Parameter	Equipment	Procedure
Oxygen	• MSA Passport® 4-gas meter • 2 ½-foot by ¼-inch capped copper tube with nipple fitting on one end and perforations on the other end • Large volume syringe for purging the copper tube	1. Visually divide pile into four quadrants 2. Insert copper tube approximately 18- to 24-inches into the soil pile in the first quadrant 3. Attach syringe to copper tube nipple fitting and purge two volumes of air from the tube 4. Attach meter to nipple fitting and collect O_2 readings 5. Repeat process in remaining 3 quadrants 6. Compare results to Table 2-4 to determine if corrective action is necessary
Temperature	• Thermocouple	1. Visually divide the pile into four quadrants 2. Insert the thermocouple approximately 18- to 24-inches into the soil pile in the first quadrant and read temperature when readout stabilizes 3. Repeat process in remaining 3 quadrants 4. Compare results to Table 2-4 to determine if corrective action is necessary
pH	• LaMotte soil test kit (or equivalent)	1. Select one of four quadrants for testing 2. Collect soil sample approximately 18- to 24-inches below the surface of the pile 3. Use soil test kit to determine pH of soil 4. Compare result to Table 2-4 to determine if corrective action is necessary
Moisture content	• Soilmoisture® tensiometer (or equivalent)	1. Select same quadrant as for pH sampling 2. Collect soil sample approximately 18- to 24-inches below the surface of the pile 3. Use meter to determine the percent of soil moisture measured as field capacity 4. Compare result to Table 2-4 to determine if corrective action is necessary
Carbon Content and Nutrient Ratio (N-P-K)	• LaMotte soil test kit (or equivalent)	1. Select same quadrant as for pH and moisture content sampling 2. Collect soil sample approximately 18- to 24-inches below the surface of the pile 3. Use soil test kit to determine C, N, P, and K relative concentrations in the soil 4. Compare result to Table 2-4 to determine if corrective action is necessary

2.5.2 Landfarming Cell Operation

The landfarming pile will be turned weekly using a backhoe. Field parameters might dictate more frequent turning if oxygen levels are measured below the operating range (see Table 2-4). Prior to turning the soil, the HDPE cover will be removed and field parameters and analytical samples will be collected as necessary. Turning will be accomplished by moving the pile from one side of the containment cell to the other side, thereby thoroughly aerating the soil. Turning will be conducted in a manner to minimize soil compaction. After turning the soil, the HDPE cover will be re-positioned over the pile. Analytical sampling frequency and methods are discussed in Section 2.6. The field parameters and collection frequencies are listed in Table 2-4; the collection procedures for each parameter are detailed in Table 2-5.

2.6 SAMPLING AND ANALYSIS

Sampling and analysis will consist of pre-study, initial, in-process, and final study sampling events. Two pre-study samples will be collected and analyzed for quantifying potential interference caused by the fish waste and wood chips. Initial and final study sampling events will provide information regarding the overall effectiveness of the treatment technologies. In-process sampling will assist in trend analysis as discussed in Section 4. Table 2-6 provides an overview of the planned sampling regime and Table 2-7 provides sample container, preservation techniques, and holding time information. Additional sampling information may be found in the Annette Island Work Plan 2000, Appendix A – Field Sampling Plan Addendum (USAED 2000a).

2.6.1 Sampling Procedures and Study Design

Efforts were made in the design of this study and the associated analytical suite to overcome several significant factors. Soil heterogeneity and interference caused by the wood and fish wastes of the compost matrix are the most salient factors identified. Random, replicate, and composite sampling procedures, as well as the clean soil control compost pile were developed and incorporated into the study design in order to minimize the impact of these factors. Additionally, all samples will be collected from at least 12 inches below the pile surface and be analyzed on a 14-day turn around time (TAT).

2.6.1.1 Replicate Sampling

Three replicate samples will be collected for each parameter (with the exception of PAHs) during initial, in-process, and final sampling events. Each replicate will be collected from a randomly selected location.

2.6.1.2 Volatile Grab Sampling Procedure

All volatile samples will be collected as systematic random grab samples; no compositing of volatile samples will occur. This will be accomplished by dividing each pile into 3 sectors, and one sample randomly collected from each sector.

2.6.1.3 Non-Volatile Composite Sampling Procedure

In order to obtain more precise estimates of the mean constituent concentrations in the soil piles, three composite samples will be collected from four randomly selected locations from each pile.

This will be accomplished by dividing each pile into 4 quadrants, and one sub-sample randomly collected from each quadrant. The four sub-samples will be placed in a stainless steel bowl and thoroughly mixed for two minutes prior to filling the sampling jar. This procedure will be repeated two additional times, resulting in three composite samples.

2.6.1.4 Control Pile

In an effort to quantify interference to fuel-related compound concentration due to the compost matrix, a clean soil compost pile was included in the study. Parallel measurements of contaminant concentrations will be measured in both the clean and fuel contaminated compost piles throughout the study. The difference between these measurements will help quantitate actual constituent concentrations in the fuel contaminated compost pile during the study.

2.6.2 Pre-Study Sampling

A pre-study sampling and analysis event will be used to assess the effects of the fish and wood wastes on laboratory analytical results. During a pre-mobilization site visit, soil from Site 42 will be collected along with samples of fish waste and wood chips. The Site 42 soil sample and a sample created by combining the soil, fish wastes, and wood chips at the ratios identified in Table 2-3 will be submitted for GRO, DRO/RRO, PAH, and VOC analyses. Matrix spike and matrix spike duplicate analyses will be requested on all analyses. The Site 42 soil sample will be thoroughly homogenized prior to any analysis and combination with the fish and wood wastes. These results will help assess the effects of dilution due to introducing fish and wood wastes, in addition to matrix interference caused by the wood and fish wastes.

2.6.3 Initial Sampling

After clean and fuel contaminated soil has been excavated and delivered to the containment cells, fuel-contaminated soils will be thoroughly mixed. Samples will be collected from both the clean and contaminated soil and submitted for GRO, DRO/RRO, VOC, PAH, total lead, and particle size distribution. Contaminated soils will then be bisected and placed into the landfarming and composting cells, and clean soil will be placed in the control cell. Soil amendments will be added to each pile, each pile thoroughly mixed, and the treatability studies initiated. Samples will then be collected from all three piles and analyzed for GRO, DRO/RRO, VOC, and PAH.

2.6.4 Process Sampling

Contaminant concentrations will be monitored in both the two compost piles and in the landfarm over the course of the study in three sampling events occurring two, four, and eight weeks after study initiation. Process sampling events will include the sampling and analysis for GRO, VOC, PAH, Heterotrophic Plate Count (HPC), and DRO/RRO. Samples will be collected from the compost pile, the control pile, and the landfarm pile with the exception that HPC will not be collected from the background control compost pile.

2.6.5 Final Soil Sampling

The final sample collection event will include sampling and analysis for GRO, VOC, PAH, Heterotrophic Plate Count, and DRO/RRO. Samples will be collected from the two compost piles and the landfarm with the exception that HPC will not be collected from the background control pile.

Table 2-6
Sample Number Summary

Parameter (Method)	GRO (AK101)	BTEX, VOCs (8260B)	DRO/RRO (AK102/103)	PAHs (SW8270C SIM)	Lead (SW7421)	HPC (SM9215D)	Grain Size
Pre-Study Sampling							
Fuel-Contaminated Soil	1	1	1	1	--	--	--
Fuel-Contaminated Soil, Fish Waste, and Wood Chips	1	1	1	1	--	--	--
Initial Sampling							
Fuel-Contaminated Soil	3	3	3	1	1	1	1
Clean Soil	3	3	3	1	1	1	1
Landfarm	3	3	3	1	--	1	--
Compost Pile – Contaminated Soil	3	3	3	1	--	1	--
Control Pile – Clean Soil	3	3	3	1	--	1	--
Process Sampling							
Landfarm	9	9	9	1	--	1	--
Compost Pile – Contaminated Soil	9	9	9	1	--	1	--
Control Pile – Clean Soil	9	9	9	1	--	--	--
Final Sampling							
Landfarm	3	3	3	1	--	1	--
Compost Pile – Contaminated Soil	3	3	3	1	--	1	--
Control Pile – Clean Soil	3	3	3	1	--	--	--
Trip Blanks	6	6	--	--	--	--	--
Quality Control (QC) Duplicates, Soil	6	6	5	2	1	2	--
Subtotal Soil Samples	**65**	**65**	**58**	**15**	**3**	**15**	**2**
Process Water	3	3	3	3	--	--	--
Trip Blank	2	2	--	--	--	--	--
Quality Control (QC) Duplicates, Water	--	--	--	--	--	--	--
Subtotal Water Samples	**5**	**5**	**3**	**3**	**0**	**0**	**0**

BTEX = Benzene, toluene, ethylbenzene, and xylenes
DRO = Diesel-range organics
GRO = Gasoline-range organics
HPC = Heterotrophic plate count
PAH = Polynuclear aromatic hydrocarbons
QC = Quality control
RRO = Residual-range organics
VOC= Volatile organic compound

Table 2-7
Sample Containers, Preservation Techniques, and Holding Times

Parameter	Method	Container[1,2]	Preservation[3]	Maximum Holding Times
Soil				
GRO	AK101	(1) 4-oz glass with septum lid	Methanol w/ BFB Cool to 25°C	28 days to analysis
DRO/RRO	AK102/103	(1) 8-oz amber glass	Cool to 4°C	14 days to extraction, 40 days to analysis
BTEX, VOCs	SW8260B	(1) 4-oz glass with septum lid	Methanol Cool to 4°C	14 days to analysis
PAHs	SW8270C SIM	(1) 8-oz amber glass	Cool to 4°C	14 days to extraction, 40 days to analysis
HPC	SM9215D	(1) 8-oz glass	Cool to 4°C	28 days to analysis
Total lead	SW6010B	(1) 8-oz amber glass	Cool to 4°C	180 days to analysis
Water				
GRO	AK101	(3) 40 ml VOAs with septum lid	PH<2 (HCl) Cool to 4°C	14 days to analysis
DRO/RRO	AK102/103	(2) 1-liter amber glass	PH<2 (HCl) Cool to 4°C	7 days to extraction, 40 days to analysis
BTEX, VOCs	SW8260B	(3) 40 ml VOAs with septum lid	PH<2 (HCl) Cool to 4°C	14 days to analysis
PAHs	SW8270C SIM	(2) 1L amber bottles	Cool to 4°C	7 days to extraction, 40 days to analysis

NOTE: Percent moisture can be taken from the same container provided for the analytical suite, with the exception of methanol-preserved samples.

1 All sample container lids shall have Teflon® liners. All methanol-preserved samples must be placed in pre-weighed containers

2 Some analyses may be combined and require only one container (if the analyses are from the same location)

3 Sample temperatures must be maintained at 4°C, plus or minus 2°C

BFB = Bromofluorobenzene
BTEX = benzene, toluene, ethylbenzene, and xylenes
DRO = diesel-range organics
GRO = gasoline-range organics
HPC = heterotrophic plate count
PAH = polynuclear aromatic hydrocarbons
RRO = residual-range organics
VOA = volatile organic analysis
VOCs = volatile organic compounds

2.7 TREATABILITY STUDY DECOMMISSIONING

At the conclusion of the treatability study, the soil remaining in the containment cells will be returned to Site 42 and the backfilled areas will be graded flat. The containment cells will be left in place for use in future projects in the area.

2.8 WASTE MANAGEMENT AND DISPOSAL

Waste management will be conducted throughout the duration of the project, while waste disposal will be conducted following study decommissioning. Waste management while mobilized at the project work area will consist primarily of incidental refuse collection and ensuring that other wastes are properly disposed of or contained.

2.8.1 Equipment Decontamination

Equipment that contacts contaminated soil will be decontaminated. Equipment decontamination will be conducted using dry techniques (i.e., removal of soil and a wipe down with sorbing pads) when possible.

A pressure washer will be used to decontaminate equipment when dry techniques are ineffective. The decontamination area cell constructed in 1999 at the quarry area will be used for this purpose. Decontamination fluids will be collected from the decontamination area and subsequently processed through the wastewater treatment system mobilized as part of the 2000 FUDS field program. Because the FUDS field program will be demobilized prior to treatability study completion, decontamination water generated following FUDS demobilization will be placed in 55-gallon drums and shipped off site for disposal.

2.8.2 Waste Transport and Disposal

Waste will be transported from the project work area to off-island disposal facilities appropriate for the waste stream. All waste characterization will be conducted as a part of routine sampling and analysis. All waste shipments will require a waste manifest.

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3.0 CHEMICAL DATA QUALITY ASSURANCE

This section defines the data quality objectives (DQO) and quality assurance/quality control (QA/QC) procedures that will be followed during the sampling activities at the project work area. The QA/QC procedures will ensure that the data generated during sampling are precise, accurate, representative, complete, and comparable. This will ensure that chemical data will be of sufficient quality to support recommendations for future site management. The data will comply with USAED and EPA requirements, as well as the project-specific DQO as defined below. This section is supplemental to the *TERC Standard Quality Assurance Project Plan* (QAPP) (USAED 1998a).

The analytical laboratory (to be determined) will perform the following chemical analyses on soil and water samples as required:

- AK 101, GRO;
- AK102/103, DRO/RRO;
- SW8260B, BTEX & VOCs;
- SW8270C SIM, PAHs;
- SW6010B, total lead;
- SM9215B, Heterotrophic Plate Count; and
- Grain Size/Sieve Analysis.

3.1 PROJECT DATA QUALITY OBJECTIVES

Project-specific DQO have been developed for this project to ensure that the data collected are of sufficient quantity and quality to meet project objectives. Specific data requirements vary depending on the nature of the data collection procedure, the site conditions, and the end uses of the data. Table 3-1 summarizes the DQO for this project. Analytical DQOs are described in Section 3.2.

Table 3-1
Project Data Quality Objectives

Decision to be Made	Samples/Data to be Collected	Analytes of Concern	Data Use	Action Levels (Regulatory Cleanup Goal)
PRE-STUDY SAMPLING				
Media: ***POL Soil, Fish Waste, and Wood Chips*** ***Location:*** ***Site 42A, Main Tank Farm***				
• What analytical interference may be caused by the compost pile matrix and how effective are the selected analytical methods at measuring POL concentrations in the soil/fish waste/and wood chip matrix?	• One soil sample and one sample created by the combination of POL soil, fish waste, and wood chips. • Matrix spike and matrix spike duplicate analyses of the fish and chips sample will be requested for all requested analytical methods.	• GRO, DRO, RRO, VOC, PAHs	• Evaluate the interference of the fish and wood wastes on target analyte recoveries	• NA
INITIAL SAMPLING				
Media: ***Background Soil, Fuel-Contaminated Soil*** ***Location:*** ***Containment Cells***				
• What are the initial contaminant concentrations, bacterial counts, and particle sizes in the background and POL contaminated soils?	• After thoroughly mixing both the background and POL contaminated soils, randomly collected samples will be collected from both the background and POL contaminated soil piles.	• GRO, VOC, DRO/RRO, PAHs, Lead, HPC, and Grain Size/Sieve Analysis	• Determine initial contaminant concentrations	• NA
Media: ***Compost – Clean Soil / Compost -- Fuel-Contaminated Soil*** ***Location:*** ***Containment Cells***				
• What are the initial contaminant concentrations, bacterial counts, and particle sizes in the compost mixtures?	• After thoroughly mixing both the background and POL contaminated soils, randomly collected samples will be collected from both the background and POL contaminated soil piles.	• GRO, VOC, DRO/RRO, PAHs, and HPC	• Determine initial contaminant concentrations in compost mixtures.	• NA

Table 3-1
Project Data Quality Objectives
(continued)

Decision to be Made	Samples/Data to be Collected	Analytes of Concern	Data Use	Action Levels (Regulatory Cleanup Goal)
PROCESS SAMPLING				
Media: ***Land Farm Soil, POL Compost Pile Soil, and Background Compost Pile Soil*** ***Location:*** ***Containment Cells***				
• At what rate are the contaminants of concern being degraded in the landfarm and compost pile soils?	• Collect soil samples from the compost piles and the landfarm containment cells	• GRO, VOC, DRO/RRO, PAHs, and HPC	• Determine degradation rates and trends	• NA
FINAL SAMPLING				
Media: ***Land Farm Soil, POL Compost Pile Soil, and Background Compost Pile Soil*** ***Location:*** ***Containment Cells***				
• Have the contaminants of concern been degraded to preliminary cleanup criteria in the landfarm and compost pile soils?	• Collect soil samples from the compost piles and the landfarm containment cells	• GRO, VOC, DRO/RRO, PAHs, and HPC	• Determine degradation rates and trends • Calculate process destruction/removal efficiency	• See Table 1-1
Leachate Sampling (if required)				
• Does leachate generated during the treatability studies require treatment or offsite disposal.	• Sample accumulated water from the containment cells	• GRO, DRO, RRO, BTEX, PAHs	• Disposal purposes	• MIC groundwater cleanup levels • Federal ambient water quality criteria

BTEX = Benzene, toluene, ethylbenzene and xylenes
DRO = Diesel-range organics
GRO = Gasoline-range organics
HPC = Heterotrophic plate count
PAH = polynuclear aromatic hydrocarbons
POL = petroleum, oils and lubricants
RRO = residual range organics

3.2 ANALYTICAL DATA QUALITY OBJECTIVES

Contaminants of potential concern for the proposed treatability studies are fuel-related compounds and VOCs as specified in Table 1-1. Maximum analytical reporting limits, on a constituent-by-constituent basis, are specified in the Standard QAPP (USAED 1998a). These limits have been reviewed to verify that constituent concentrations will be reported at or below the preliminary cleanup criteria specified in Table 1-1 for soil. For water, MIC cleanup levels, State of Alaska standards, and federal ambient water quality standards were also compared to the maximum analytical reporting limits; all constituents were in compliance.

4.0 DATA ANALYSIS AND INTERPRETATION

Data analysis and interpretation will be conducted over the course of the treatability studies to optimize the degradation process and to determine the effectiveness of the technologies. Effectiveness of the treatability studies will be determined as follows:

- Determine if the technologies can reduce constituent concentrations to or below the preliminary clean up criteria presented in Table 1-1; and
- Calculate the overall contaminant destruction/removal efficiency.

A review of existing literature indicates that complete biological treatment of fuel-contaminated soil requires at least 12 months. Because the treatability studies are currently scheduled to last approximately 3 months, final concentrations may not be reached. Therefore, trend analyses and extrapolation will be required to predict final constituent concentrations.

Constituent concentration decrease is generally expected to follow a biological decay function, and can be theoretically expressed as follows:

$$C(t) = C_i e^{kt}$$

Where:

$C(t)$ is the constituent concentration at time t during the study;
C_i is the initial constituent concentration;
k is the biological decay constant (negative value); and
t is time.

Replicate data obtained during the treatability study will be plotted and visually examined for trends. If the data exhibit an exponential trend, then the final constituent concentration and the practical time required to reach that concentration will be predicted based upon when the biological decay function becomes asymptotic. Additional literature searches may be performed to identify decay constants determined from other studies, which may help to predict when asymptotic conditions occur.

For the composting treatability study, efforts will be made to quantitate biogenic interference due to the addition of fish and wood wastes. This will be accomplished by comparing sample results from the fuel-contaminated compost pile to sample results from the clean compost pile throughout the study. Chromatograms will also be examined for indications of biogenic interference. Theoretically, the difference between these results will be the quantitated biogenic interference and will be discounted from the fuel-contaminated sample results to yield actual concentrations of fuel-related compounds.

The process destruction/removal efficiency will be based on initial and final constituent concentrations, and will be calculated as follows:

$$\eta = \left(\frac{C_i - C_f}{C_i} \right) 100$$

Where:

η is the contaminant destruction/removal efficiency in percent;
C_i is the initial constituent concentration; and
C_f is the final constituent concentration.

Although somewhat academic, the destruction/removal efficiency provides an important measure of the process performance.

Data will also be evaluated over the course of the treatability study to determine if certain constituents can be omitted from further analysis. If constituents are not noted to be present in initial soil samples, then those constituents will not be tested further during the study. Similarly, if concentrations of certain constituents become non-detect during the study, then those constituents will not be further analyzed.

5.0 ENVIRONMENTAL PROTECTION

Project activities will cause limited impact to the surrounding environment. The site-specific Environmental Protection Plan provided in the Annette Island FUDS 2000 Work Plan is applicable to all field work conducted in support of the treatability studies (USAED 2000b).

Spills of petroleum products are not anticipated. In the event that a spill does occur, the Spill Prevention Plan provided in the *TERC Standard Environmental Protection Plan* (EPP) (USAED 1998b) will be used as a guide for spill response activities (on file in Jacobs field office). The Standard EPP will also be consulted for guidance for other environmental protection issues that may arise during the project.

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6.0 HEALTH AND SAFETY

A job hazard analysis was conducted for the entire Annette Island 2000 field program. The job hazard analysis, in addition to a site-specific health and safety plan, are included in the 2000 Annette Island FUDS Work Plan (USAED 2000b).

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7.0 QUALITY CONTROL

The USAED three-phase quality control system will be implemented on this project to ensure that work complies with industry standards and site-specific requirements. The three-phase system consists of the following phases:

- Preparatory phase;
- Initial phase; and
- Follow-up phase.

Each phase will be implemented for each DFW identified in Section 2 of this report. Quality control-related forms are included in the 2000 Annette Island FUDS work plan (USAED 2000b).

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8.0 REPORTING

Daily and weekly reports will be submitted to the USAED over the course of the studies. These reports will summarize daily work production and other issues pertinent to maintaining work progress according to safety, quality, schedule, and budget. The daily and weekly reports will become a permanent record of the project, and will be prepared in accordance with the *TERC Standard Contractor Quality Control Plan* (CQCP) (USAED 1998e).

Hazardous substance spills, if any, will be reported to the USAED in a timely manner. The USAED will report spills to the appropriate regulatory authorities.

A summary report will be prepared at the end of the treatability studies to document results of the treatability studies. This report will also include a detailed analysis and interpretation of the data collected over the course of the studies, and will provide recommendations based on results of the study.

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TASK ORDER 14—ANNETTE ISLAND

Serial No.: 186

Subject: Technical Memorandum – DRAFT
Composting & Landfill Treatability Studies

Doc. Control No.: AKT-J07-05M314-J02-0006

Date: 5 July 2000
From: Lyn Dokoozian
Company: Jacobs Engineering Group Inc.

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Suspense:

Signature: T.A. Dean FOR
Lyn Dokoozian, Project Manager

Date: 5 July 2000

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